PECULIARITIES OF WEATHERING IN THE POTTSVILLE CONGLOMERATE.

The striking characteristics of the Pottsville conglomerate in eastern Pennsylvania are its highly siliceous composition and its solidity. Owing to a consequent great durability, it stands out prominently along the

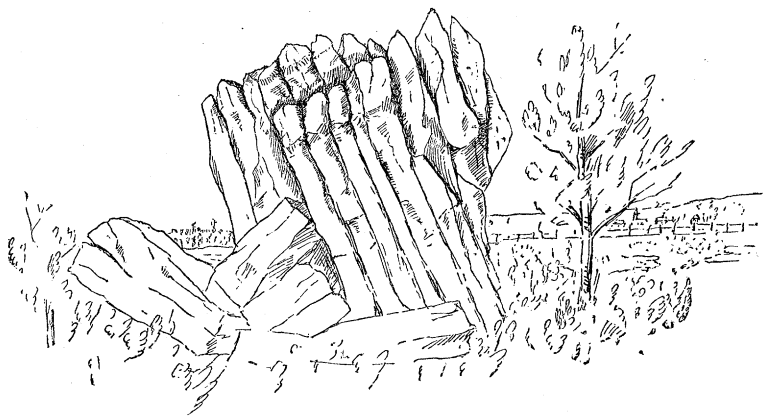

Fig. 1.—Outcrop showing weathering along the plane of stratification.

different mountain ridges which surround the anthracite coal-basins; but though, as compared with the associated rocks, its resistance to weathering is very great, the effects of this action are everywhere revealed on examination.

The surfaces of the finer and more compact varieties are frequently seen to be covered with numerous small holes, or pit-marks, resulting from the removal of separate grains. Blocks of the coarse pudding-stone have generally a very rough surface, the pebbles projecting half their thicknesses above the surrounding matrix; and fragments of this rock are sometimes so thoroughly permeated and softened by percolating water that they can be crushed to grains by the hand.

Along the planes of stratification the subaerial decay of this rock is particularly well marked. Deep clefts and gashes are found along these planes, which frequently cut entirely across large masses, dividing them into separate slabs. This action is best developed along the upturned edges of steeply inclined dips, where water has the best opportunity to accumulate and to prolong its action in incipient grooves; and, with isolated blocks only slightly inclined, the increased decay along the upturned edges, due to this same cause, is often noticeable. A somewhat remarkable fact about such weathering is, that clefts parallel to the stratification are found in an apparently homogeneous rock. In such cases a difference or deficiency of cementing-material must be the directing cause.

Weathering action across the plane of stratification is exhibited in its first stages by shallow and narrow grooves, which run sinuously across the rock. These have their origin in little streams of rain-water which flow from the surface down the sides of the rock. Once started, such a groove forms a channel whose drainage capacity constantly increases as the depression enlarges; and by degrees the fine groove grows to a decided fissure, half a foot or more across, which the continued action of rain-water cuts deeper and deeper into the rock. This fissure is generally of approximately uniform breadth; but, as it enters farther into the rock, the water drains into it from all sides, and an enlargement is sometimes formed at the end, which I have seen to result in an almost circular hole, completely penetrating the rock.

The most peculiar and remarkable of all the results of this weathering action are, however,

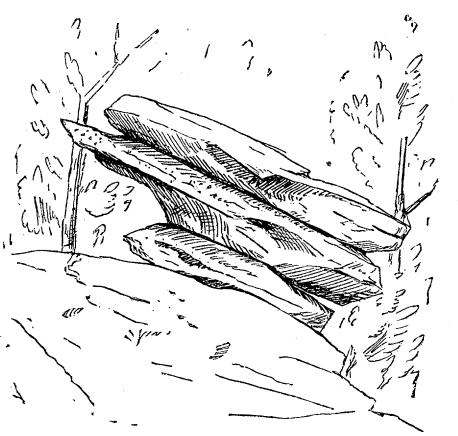

Fig. 2.—Isolated conglomerate mass showing increase of weathering along the planes of stratification on the upturned edge.

those produced by a superficial action in the plane of stratification. Over flat surfaces of the rock, white, washed-looking patches occur; but where a slight depression exists, the water

accumulates and stands, and as a consequence the grains of the rock in immediate contact are loosened, and, on the evaporation of the water, blown away. Thus the depressions which were at first, perhaps, only a fraction of an inch, are deepened, and, by degrees, basins of as much as a foot in depth are eaten out. These are often so regular in outline, and with such smooth sides, that they might readily be mistaken for pot-holes; and, indeed, it was such that I first considered them, and was puzzled to account for the peculiar channel in which the waters producing them must have flown. A distinguishing feature of these depressions, however, is that each one has an outlet cut down to near the bottom of the cavity; and this is easily accounted for, on the theory of their subaerial origin, by considering, that, once such a basin started, the overflow would always pass off over the lowest edge, and as the basin increased in depth, by continued dissolving action, so would the outlet also. A further confirmation of this is furnished by the facts, that in inclined rocks the outlet is always towards the lower rim, and the bottom of these cavities is either horizontal or sloping towards the outlet. In the bottom is also generally accumulated a small amount of gravel and sand recently loosened from the bed. These basins are of all sizes, up to three feet and more in diameter. Their shapes are varied, — sometimes circular, sometimes oblong, — with gently sloping sides, or steep, even re-curving ones, according to the character of the rock. They are frequently connected in strings by narrow channels, like a miniature lake system; and, with the enlargement of these channels, a simple, deep groove across the rock results, all this action combining to give the rock a very rugged appearance.

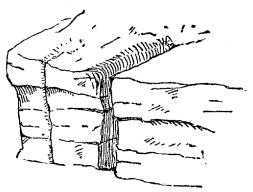

FIG. 3. — Weathering across the plane of stratification.

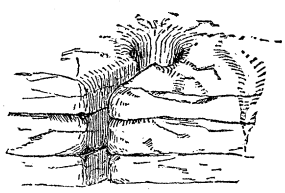

FIG. 4. — Enlargement at end of fissure.

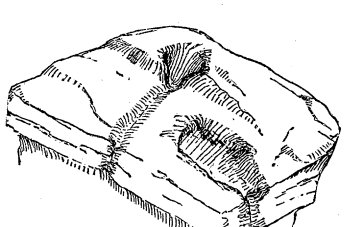

FIG. 5. — The results of superficial weathering in the plane of stratification.

The very preponderance of silica grains in this rock, to the exclusion of any good cementing-material, is probably one of the chief reasons for its decay. Rain-water is, without doubt, one of the most active agents; but the secretions from the thick growth of moss and lichens, which frequently covers the surface and penetrates into the cavities of the rock, have probably also their effects. The deep gashes produced by the action of the rain-water offer excellent opportunities for frost to continue the work of destruction; the ice forming in these clefts, and, by its prying action, completing the separation of the already partially divided mass.

As a consequence of this wide-spread weathering process, large continuous outcrops are rarely found. Collections of huge blocks generally mark their site; and the thick accumulations of smaller fragments, which are so frequently found over conglomerate areas, result, without doubt, from the further subdivision of these larger blocks.

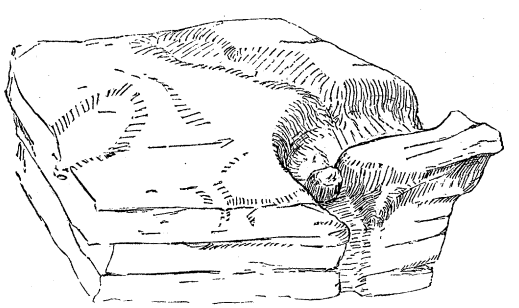

FIG. 6. — Large basin in conglomerate, with a double outlet.]

The products of decay either accumulate in place, are washed down by streams, or blown away by the wind. On the top of Broad Mountain, and elsewhere, the disintegration *in situ*, I am informed, is so great that the loose rock is dug out as gravel; and, in valleys watered by streams flowing down from conglomerate ridges, deep deposits of siliceous sand are found, valuable for building-purposes.

The decay of the sandstones and shales, associated with or underlying the conglomerate, is even more pronounced than in that rock. Changes of color, especially from the greenish tints to red, brown, and yellow, are the most

frequent results; and this is often accompanied by a softening to a barely coherent sand or clay. Erroneous conclusions are thus frequently drawn from surface indications, as to the nature of the underlying rock.

The subject of the decay of rocks has recently been admirably treated by Dr. T. Sterry Hunt,[1] chiefly with regard to the crystalline rocks; and it deserves to be further studied, in the case of these more recent rocks, from its evident importance in chemical geology, its interesting and well-known relation to topography, and its economic bearing. ARTHUR WINSLOW.

Pennsylvania geological survey.

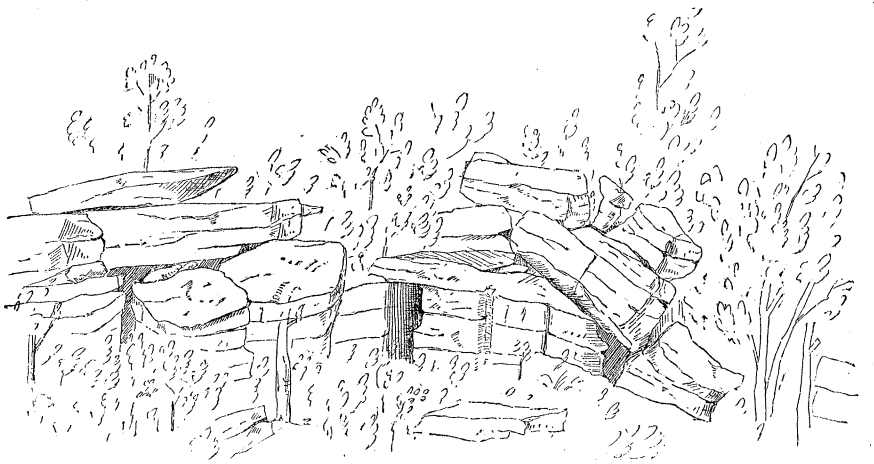

FIG. 7. — Broken conglomerate outcrop.

ELECTRIC LIGHT TESTS AT THE LOUISVILLE EXPOSITION.

THE display of electric lights at the Louisville exposition, as to number, was the greatest ever made in and around one building. The number of lights used varied somewhat, but the average was about as follows: —

	Incandescent lights.	Arc-lights.
Edison isolated lighting company . .	4,600	–
U. S. electric light company	210	29
Fort Wayne Jenney electric light company	–	100
Thomson Houston electric light company	–	36

The jury — consisting of Benjamin Rankin, Louisville; W. W. Weaver, Chicago; Charles Smith, J. A. Tanner, M.D., and H. W. Eaton, Ph.D., Louisville — was not appointed till about three weeks before the close of the exposition: hence thorough tests were impossible.

As the U. S. company did not enter into the contest, there was no competition on the incandescent lights. However, the following tests were made: connection was made with a circuit containing 315 lights at what was considered an average point in the circuit; and fifteen lamps, five of them new and the balance selected systematically from the circuit while lighted, were tested in a specially constructed photometer-room while indicator-cards were being taken from the engine.

A Bunsen photometer with a twelve-foot bar was used, and the horizontal intensity determined with the carbon at an angle of 45°. The intensity of the (nominally) 16-candle lights varied from 12 to 19.66 candles, averaging 13.77 candles; and the average horse-power was 32.50. These figures give 9.70 lights, or 133.57 candles, per mechanical horse-power.

The action of the automatic regulator was then tested with a light in the photometer, first 50 and then 100 lights being thrown off and on. In one of the six cases the variation was 1.23 candles, but in all the others it was less than .66 of a candle. Only a momentary flicker was noticed as the lights were thrown off and on.

The jury reported as follows: "The tests of the Edison system are most satisfactory as to the efficiency of the various appliances, the steadiness of the light produced, and the general results. It is a matter worthy of note, that

[1] The decay of rocks geologically considered. By T. Sterry Hunt, LL.D., F.R.S. *American journal of science*, September, 1883.